

Fieldwork

Sediment Impacts on Reef Corals in Maui, Hawai'i

By Greg Piniak

In tropical islands with high elevations, terrestrial runoff can pose a severe threat to the health of surrounding coral reefs. Fine terrigenous sediment entering the nearshore ocean during runoff events affects corals in two ways: (1) suspended in seawater, the sediment drastically reduces the amount of light reaching coral reefs and other shallow benthic systems; and (2) as the sediment settles, it can bury corals or cause them to expend a large amount of energy keeping their surfaces clean. Although a clear link exists between high sediment loads and coral-reef degradation, the mechanisms responsible for coral decline are not well quantified.

July 2004 marked the end of a year-long field study of the growth of *Pocillopora damicornis* coral transplants at five sites along the west coast of Maui, Hawai'i. In addition to two relatively undeveloped sites, at Sugar Beach and Olowalu Beach, three sites were established in the highly developed Ma'alaea Small Boat Harbor, which has a sediment gradient ranging from fine, terrigenous mud at the west end of the harbor to coarse marine sand near the harbor mouth. An added benefit of working in the harbor is that the coral-growth data collected there can provide a baseline for evaluating proposed projects to redesign the breakwater and expand the harbor.

All coral transplants were collected from a donor site in the center of the harbor, where the water is calm and the sediment impact moderate. Growth rate was measured seasonally, using the buoyant-weight technique; sediment traps were deployed approximately monthly.

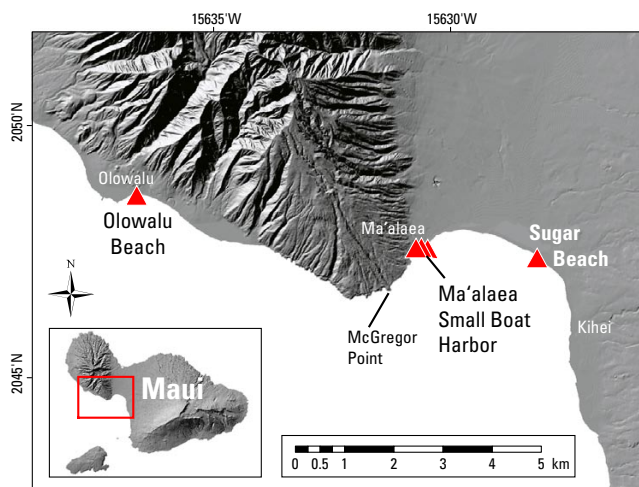
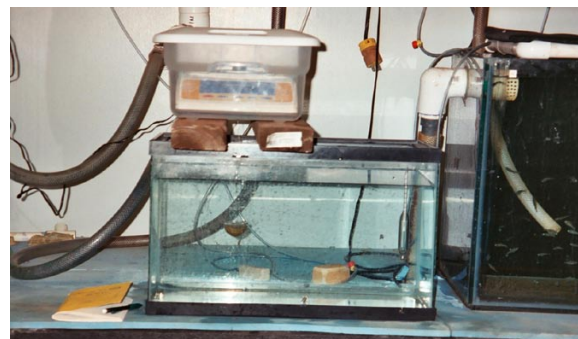
During the study period, coral-transplant growth in the harbor negatively

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Sediment burying a coral reef. Photograph by Mike Field, USGS.

Coral buoyant-weight apparatus at the Maui Ocean Center. This apparatus allows the coral to be weighed underwater, thus preventing damage that would occur to the coral if it were weighed in air. Photograph by Greg Piniak.



Coral-transplant sites along the west coast of Maui. Map by Joshua Logan, USGS.

Sound Waves

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Submission Guidelines

Deadline: The deadline for news items and publication lists for the February 2005 issue of *Sound Waves* is Wednesday, January 12.

Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.

Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator® files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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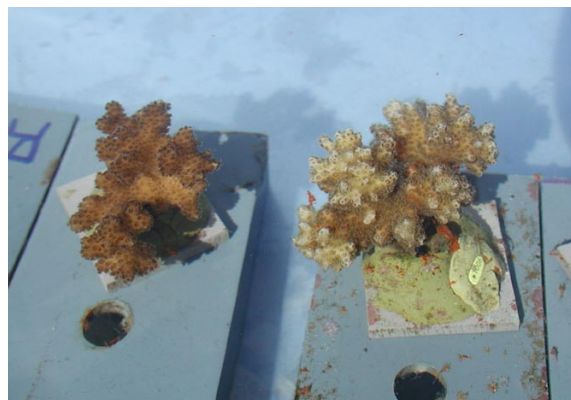
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Fieldwork, continued

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correlated with sediment load and positively correlated with light levels. At the muddy site in the west end of the harbor, corals had high survivorship but did not grow. Transplants there photoadapted to lower light levels caused by suspended sediment, and they bleached when low wave energy allowed excess mud to settle on top of the corals and smother them. The coral transplants at the donor site in the harbor had high survivorship and high growth rates, with rapid increases in colony volume. At the east end of the harbor, growth of the coral transplants was affected not only by sediment load and light levels, but also by mortality due to fish grazing and periodic algal blooms. The coral transplants at Sugar Beach grew as well as at the donor site during the summer, but with a different morphology: corals in the sheltered harbor site grew larger, lighter skeletons than the corals at Sugar Beach, which had smaller, denser skeletons in response to the beach's higher wave action. For most of the year, however, coral growth at Sugar Beach was removed because of mortality from storm waves or extended periods of south swell. Growth at the Olowalu Beach site was also affected by wave damage and by fish grazing.

To complement the field study, a week-long laboratory experiment was carried out in July 2004 to determine the short-term effects of sediment exposure on coral health. Fragments of two coral species,

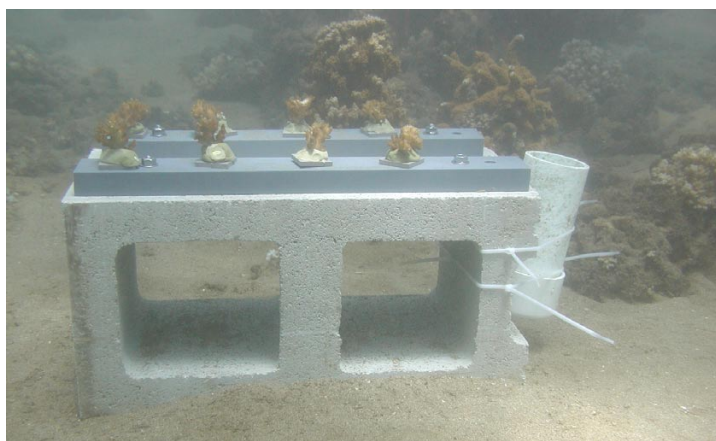


Photoadaptation of Pocillopora damicornis coral transplants. The coral on the left was exposed to high turbidity, low light, and muddy sediment and has become more darkly pigmented; the coral on the right is from clearer water with less sediment. Photograph by Eric Brown.

Montipora capitata and *Porites lobata*, were exposed to either carbonate sand or terrigenous mud for intervals ranging from 6 to 45 hours. A pulse-amplitude-modulated (PAM) fluorometer was used to measure stress effects, as determined by the fluorescence yield of the symbiotic zooxanthellae.

The two coral species in the experiment differed in their response to sediment stress, which was influenced by the length of the exposure and the type of sediment used. After 6 hours of sediment coverage, corals were slightly damaged but recovered quickly. After 30 hours, however, corals were severely damaged, and even after the sediment was removed, coral health continued to decline for another 24 hours before recovery began. The effects of terrigenous mud were more severe than those

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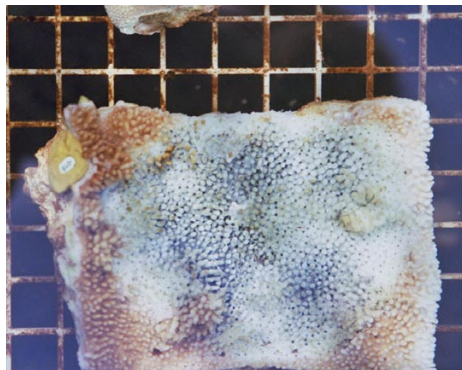
Pocillopora damicornis coral transplants at the donor site in the Ma'alaea Small Boat Harbor. Photograph by Eric Brown.

Fieldwork, continued

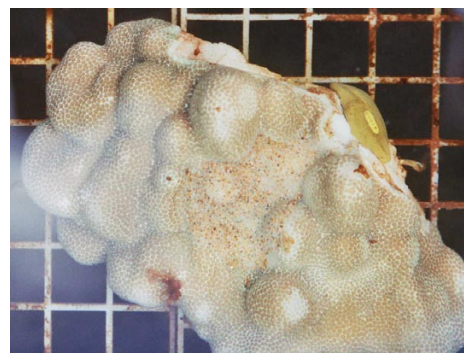
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of carbonate sand. The species *P. lobata*, though vulnerable to long-term mud exposure, was able to minimize sediment stress because its mounding morphology helped shed sediment from the colony surface. In contrast, flat *M. capitata* fragments were not efficient at sediment removal and were more severely damaged.

This research was conducted by **Greg Piniak** (U.S. Geological Survey [USGS] Pacific Science Center, Santa Cruz, CA) as part of the USGS Mendenhall Postdoctoral Research Fellowship Program. Collaborators included **Eric Brown** (University of Hawai'i) and the staff of the Maui Ocean Center. ❁



Montipora capitata coral fragment after 45 hours of sediment exposure. Healthy tissue remains around the margins, but the middle of the colony is mostly dead. Photograph by **Greg Piniak**.



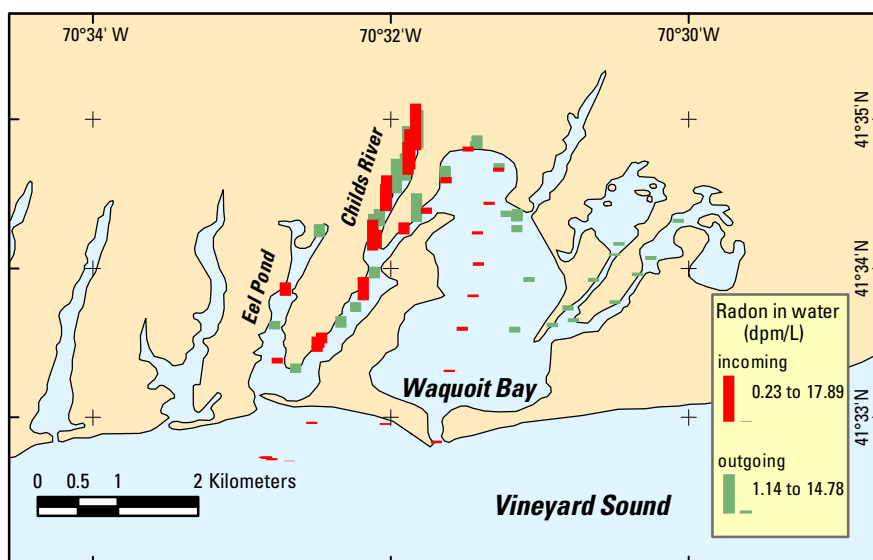
Porites lobata coral fragment after 45 hours of sediment exposure. The mounding surface shed most of the sand; however, some sediment pooled in the center of the colony and caused tissue damage. Photograph by **Greg Piniak**.

Putting Radon to Work: Identifying Coastal Ground-Water Discharge Sites

By **John Crusius**

When most people think of radon, they think of the naturally occurring, odorless, radioactive gas that can cause health problems when it reaches unsafe levels in basements. The health concerns arise because radon can accumulate in the pore spaces of soil and sediment, and the gas can make its way through cracks and fissures into the basement. For many of the same reasons that radon is a nuisance in basements, radon is also an excellent tracer of ground-water discharge to the coastal ocean. With this application in mind, a team of scientists at the U.S. Geological Survey (USGS) Woods Hole Science Center and the Woods Hole Oceanographic Institution (WHOI) set out to develop a system for mapping radon activity in coastal waters. A similar system has been developed by Professor **Bill Burnett** of Florida State University.

In recent years, it has become increasingly clear that submarine ground-water discharge plays an important role in delivering water and nutrients to coastal waters (see related article in *Sound Waves*, June 2004, at URL <http://soundwaves.usgs.gov/2004/06/research4.html>). Ground water can play an important role in delivering nutrients because the nutrient concentrations generally are far greater in ground water than in surface waters. Elevated nutrient loads, primarily in the forms of nitrate and ammonium ions, can



Map of radon activities in the vicinity of Waquoit Bay, Cape Cod, MA, generated during a one-day survey. The red bar lengths are scaled proportionally to the radon activities measured as the vessel traveled into the study area, from Vineyard Sound to the north end of Eel Pond (the "incoming" transect), and the green bars denote activities measured as the ship traveled back along approximately the same path (the "outgoing" transect). Elevated radon activities at any site are an indication of significant ground-water discharge. dpm/L, disintegrations (number of radon atoms decaying) per minute per liter.

fuel problematic algal blooms in coastal waters. Identifying the locations of coastal ground-water discharge has proved difficult, however, because the discharge is typically diffuse and below the water surface. New techniques for identifying and quantifying this discharge are clearly needed.

In the same way that radon accumulates

in soil, it also commonly accumulates in ground water. Radon activity is much lower, by contrast, in seawater. The large difference between ground-water and surface-water activities, together with radon's inert geochemical behavior, makes radon an excellent tracer of ground-water discharge to the coastal ocean. Although techniques

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for measuring radon activity have existed for many years, these old methods were time consuming and labor intensive. New technology developed in recent years allows rapid, in-place measurement of radon activity (within 30-60 minutes, depending on the activity), permitting data collection at far greater spatial resolution than was previously possible.

The first field test of a new system for mapping radon activity in coastal waters as a tracer of submarine ground-water discharge was carried out recently in a set of estuaries surrounding Waquoit Bay near Woods Hole on Cape Cod, MA. Participants in the effort included **John Crusius, John Bratton, Dirk Koopmans, Kevin Kroeger, Dann Blackwood, Sarah Kelsey, and VeeAnn Cross** from the USGS Woods Hole Science Center, and **Matt Charette, Meagan Gonneea, and Ed Hobart** from WHOI. This system was developed and tested with financial support from the USGS Geology Discipline's Venture Capital Fund.

The new radon-mapping system uses a high-flow bilge pump to transfer seawater to a spray chamber that strips the radon out of the water and into the gas phase. This spray chamber is connected to a series of radon analyzers, each of which measures the radon activity in air from the spray chamber during overlapping time periods. In this way, estimates of the average radon activity can be generated every 5 to 10 minutes. In addition, navigation, depth, salinity, and temperature data are generated at much higher frequency than in earlier mapping systems. All of the data can be monitored from a shipboard computer and recorded, in real time, to a data file,



Air-water equilibrator that strips radon from surface water into the gas phase. Water is pumped into the device and sprayed in a fine mist from a nozzle at the top. The gas phase is then pumped to a radon detector.

using special software developed for this project. These data can then be mapped by using conventional mapping software. The spatial resolution achieved is limited only by the boat speed and by the equilibration time of approximately 20 minutes required to adjust to new radon activities.

The data from the Waquoit Bay test cruise reveal extremely high radon activities in the Childs River estuary to the west, suggesting considerable discharge of ground water in that region. By contrast, radon activities in the bays immediately east of Waquoit Bay are far lower. Determining the reasons for these differences will require additional study.

This radon-mapping system is a valuable new tool for locating sites of ground-water discharge. It complements the electrical-resistivity technique, which identifies fresh ground-water discharge in the subsurface on the basis of the higher electrical resistance of freshwater relative to seawater (see article in *Sound Waves*, June 2004, at URL <http://soundwaves.usgs.gov/2004/06/fieldwork.html>). Together, these new tech-

nologies offer unprecedented sophistication for locating sites of ground-water discharge through rapid regional surveys. Such sites, once pinpointed, can then be studied in greater detail to characterize their geochemistry and to quantify the flux of water and nutrients from ground water at any given coastal location. ❁



RAD7 portable radon detector (made by the DurrIDGE Co., Bedford, MA). A pump circulates gas to the detector in a closed loop connected to the air-water equilibrator.

Mapping Benthic Habitat Around Oil Platforms in the Santa Barbara Channel, California

By Guy Cochrane

U.S. Geological Survey (USGS) scientists **Pete Dartnell** and **Guy Cochrane** conducted multibeam mapping in the eastern Santa Barbara Channel from August 5 to 15 aboard the research vessel *Maurice Ewing*. The survey was funded by the Minerals Management Service, whose

staff are interested in maps of hardbottom habitats, particularly natural outcrops, that support reef communities in areas affected by oil and gas activity. The maps are also useful to biologists studying fish that use the platforms and the sea floor beneath them as habitat.

The main survey area is adjacent to an area previously mapped with a multibeam sonar system by the Monterey Bay Aquarium Research Institute (MBARI; see URL <http://www.mbari.org/data/mapping/SBBasin/>) and extends eastward a sufficient

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distance to encompass oil platforms in the region. Data from this part of the survey, which includes Platforms Habitat, Grace, Gilda, Gail, and Gina, will be used to delineate and characterize benthic habitats and geology for improved management of fisheries and other natural resources.

Good weather and the absence of operational problems allowed mapping of two additional areas: (1) part of the submarine canyons along the continental slope south of Port Hueneme; and (2) the Footprint area south of Anacapa Island, which has been studied extensively by rockfish biologists and is considered a good site for a marine protected area.

Mapping of the sea floor was continuous, and the technology permitted mapping beneath the platforms, where hardbottom has been created through the biologic activity associated with the platform structure. Invertebrates, mainly mussels, attach to the tops of platforms and eventually fall to the sea floor, where their shells accumulate in mounds below the platforms. The recently collected mapping data, now being interpreted, will provide more information about these mounds and about the natural seabed in this part of the Santa Barbara Channel, which is likely dominated

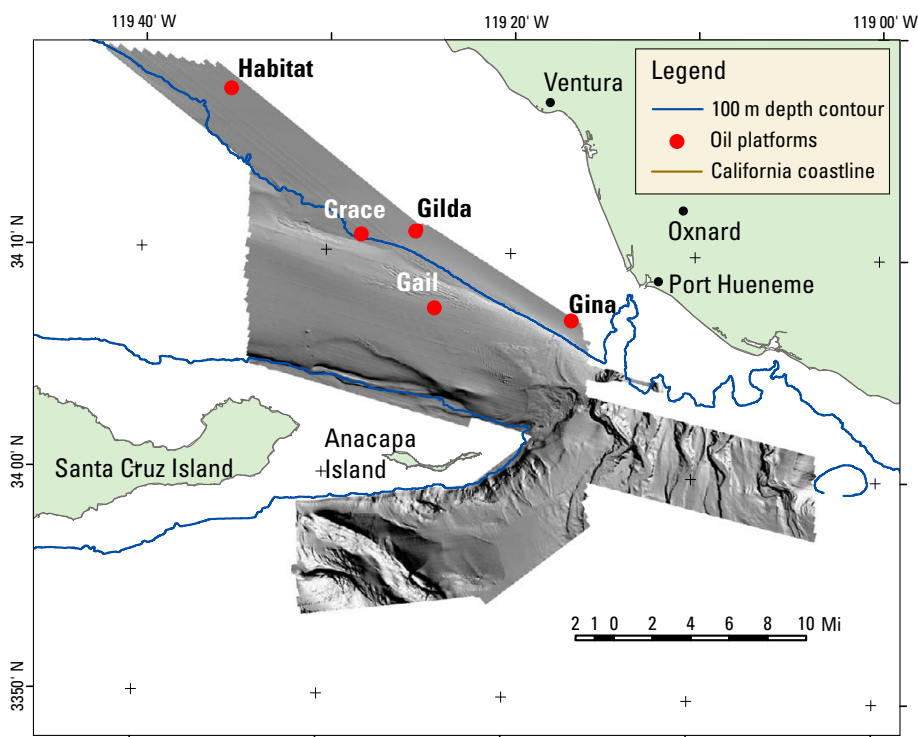


Platform Gina. Oil platforms in Santa Barbara Channel provide habitat for rich and diverse assemblages of fish, particularly rockfish.

by sedimentary deposits surrounding rare rocky outcrops. Of interest to the Minerals Management Service are the locations and relief of hardbottom features that support reef communities in areas that could be affected by oil and gas operations, such as anchoring and pipeline replacement.

Proposals by two companies to place liquefied-natural-gas (LNG) facilities in this area, including a proposal to use Plat-

form Grace as a docking site for ships, have led to a USGS report about potential geologic and seismic hazards. Additional information is available in the *Sound Waves* article "Report on Hazards Off-shore California's Ventura County Coast Compiled in Response to Congressional Request," this issue; the USGS report is available at URL <http://pubs.usgs.gov/of/2004/1286/>. ❁



Area of the recent survey. The main part of the survey area, which is shaped like a narrow wedge opening to the northwest, encompasses five oil platforms. Favorable conditions allowed mapping of additional areas south of Anacapa Island and south of Port Hueneme.



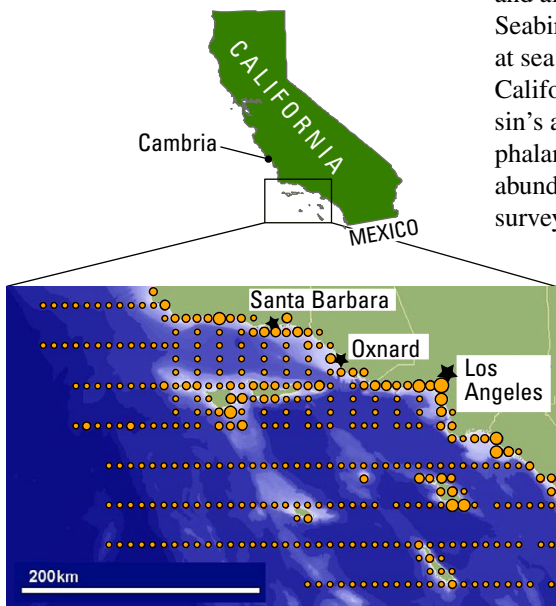
Seabirds off Southern California—Surveys Reveal Patterns in Abundance and Distribution

By Josh Ackerman, John Mason, and John Takekawa

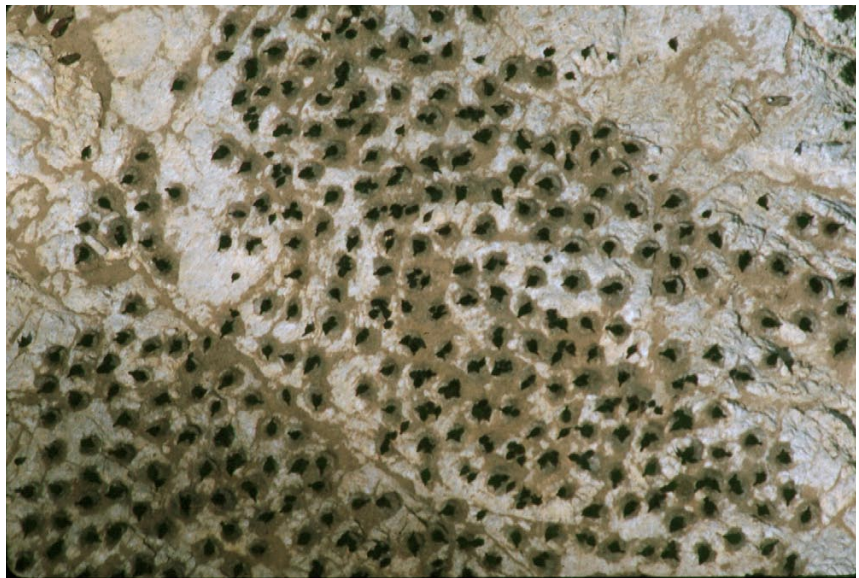
From 1999 to 2003, a team of researchers from the U.S. Geological Survey (USGS) and Humboldt State University (HSU), in cooperation with the Minerals Management Service (MMS), conducted a project to study the at-sea distribution and abundance of seabirds off the southern California coast, from Cambria, CA, to the United States-Mexico border. This region includes critical habitat for numerous seabird species, and more than 20 species of seabirds breed here, primarily on the Channel Islands, including 4 threatened or endangered species. Southern California waters also are used extensively by people and are economically important, contributing about \$9 billion annually to local economies through offshore oil production, oil transportation by tankers, commercial shipping, commercial fishing, military activities, and public recreation. Such high demands on southern California waters can cause conflicts between ecological and economic interests, and these potential conflicts prompted our study.

Using aerial surveys, researchers identified 54 species of seabirds, belonging to 12 families, and counted more than 135,000 seabirds during surveys conducted in January, May, and September of

each year. In total, researchers flew more than 102 days and surveyed 55,000 km of transect lines. These data indicate that about 1 million seabirds use the area off southern California during January, with slightly reduced abundances in May and September. Seabirds were mainly concentrated near the northern Channel Islands and along mainland and island coasts. Seabird species that were most abundant at sea during the January surveys include California gulls, western grebes, and Cassin's auklets, whereas sooty shearwaters, phalaropes, and western gulls were most abundant during the May and September surveys.



Average density of seabirds counted during January surveys, 1999-2003, in the central part of the study area (study was conducted from Cambria, CA, to the United States-Mexico border). Largest dots indicate 589 to 1,172 seabirds/km²; smallest dots indicate 0 to 41 seabirds/km². In general, seabirds were concentrated near the northern Channel Islands and along mainland and island coasts.



Aerial view of a nesting colony of Brandt's cormorants in the Channel Islands. Learn more about this large seabird at URL <http://www.mbr-pwrc.usgs.gov/id/framlst/i1220id.html>. Photograph by Gerry McChesney.

Current seabird densities were also compared with historical data collected in the same area more than two decades previously. Current seabird densities were determined to be 14 percent (January), 57 percent (May), and 42 percent (September) below historical estimates. Species with notable declines included common murres, sooty shearwaters, and Bonaparte's gulls. But not all species declined—in fact, brown pelicans, Xantus's murrelets, Cassin's auklets, ashy storm-petrels,

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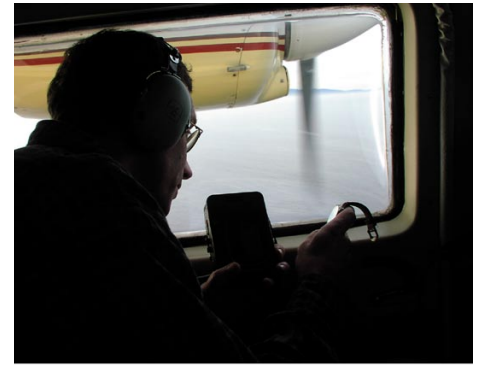
Aerial view of Prince Island, off the northeast coast of much larger San Miguel Island in southern California's Channel Islands. Photograph by Josh Adams, USGS.

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western gulls, and Brandt's cormorants have all increased in abundance. Changes in the marine environment, both biologic and anthropogenic, probably have affected the abundance and distribution of seabirds off southern California. USGS researchers will continue seabird research off southern California and are currently conducting radio-telemetry studies on ash storm-petrels.

Science Team: **John Mason** (HSU at time of study, now with USGS and

University of California, Davis), **Gerry McChesney** (HSU at time of study, now with U.S. Fish and Wildlife Service [FWS]), **Bill McIver** (HSU at time of study, now with FWS), **Harry Carter** (HSU), **John Takekawa** (USGS), **Rick Golightly** (HSU), **Josh Ackerman** (USGS), **Dennis Orthmeyer** (USGS at time of study, now with California Waterfowl Association), **Bill Perry** (USGS), **Julie Yee** (USGS), **Mark Pierson** (MMS), and **Mike McCrary** (MMS).✱



Observer **Bill McIver** records data. Photograph by **Gerry McChesney**.

How Suspended Organic Sediment Affects Turbidity and Fish Feeding Behavior

By **Mary Ann Madej**

Salmon need clear water to see their prey, such as aquatic insects and other macroinvertebrates; yet many of these same prey feed on suspended organic particles that cloud the water. Salmon health, then, depends on a balance between water clarity and the turbidity caused by suspended organic particles that sustain their prey. A team of researchers from the U.S. Geological Survey (USGS) and Humboldt State University are taking a close look at this balance, partly in response to concerns about coastal streams whose water clarity is becoming increasingly impaired by such land uses as grazing, mining, timber harvest, and road construction. **Mary Ann Madej** and **Margaret Wilzbach** of the USGS and **Kenneth Cummins**, **Samantha Hadden**, and **Colleen Ellis** of Humboldt State University are investigating the interactions among suspended sediment, turbidity, and salmon in northern coastal California streams and estuaries.

Turbidity in streams and estuaries is produced by particles, both organic and inorganic, suspended in the water column. Organic particles come from various sources within and around streams, such as algae and leaf litter; inorganic particles come from erosion of the surrounding hills and are washed into streams during storms. During high streamflows triggered by storms, inorganic particles, such as sand and silt, make up most of the suspended sediment in the turbid water. As the flow declines, the inorganic particles



A biologist makes underwater observations of fish feeding behavior during low-turbidity conditions in northern coastal California. Photograph by **Samantha Hadden**.

settle out of the water, and the lighter, organic particles remain. The organic particles that remain in suspension cause low to moderate turbidity and so decrease the light passing through stream waters, at the end of and between storms. A decrease in light may lead to a decrease in algal production and, in turn, to a loss of the invertebrates that feed by scraping algae from rocks and logs. At the same time, an increase in the amount of suspended organic particles can benefit filter-feeding invertebrates.

Both scrapers and filter feeders are important components in the diets of salmon and other drift-feeding fishes. We do not know how the ratio of organic to inorganic suspended sediment affects the availability of these prey for fish. Apart from affecting fish indirectly by affecting their food base, an increase in the amount of suspended

organic sediment affects fish directly by making it harder for them to see their prey, leading to reduced feeding efficiency, reduced feeding rate, and depressed growth.

The relations described above show that the food web of which salmon are a part is extremely complex, in which a change in one parameter, such as suspended organic sediment, can both benefit salmon and, at the same time, put them at a disadvantage. We are investigating a piece of this complex web by studying the relative amounts of inorganic and organic particles of various sizes in the suspended-sediment load of streams at various levels of flow. Our objective is to establish the relative importance of inorganic and organic particles in influencing turbidity, sediment flux, and stream health, as reflected in the feeding efficiency of juvenile salmon and the com-

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position and abundance of their invertebrate food base.

The first phase of the project concentrated on four streams draining redwood-dominated watersheds. An existing stream-gauging program with suspended-sediment sampling was supplemented by more intensive biologic sampling. The parameters we assessed include turbidity, fluorescence (as an index of chlorophyll-a), dissolved oxygen (as an index of microbial respiration), and abundance of macroinvertebrate functional groups (such as scrapers, grazers, filter feeders) collected with a drift benthos sampler, which estimates the abundance of invertebrates entering the water column from the substrate within a 1-m² area. Foraging efficiencies of juvenile salmonids were estimated in the field by underwater visual observations. Fish condition was estimated from length, mass, and age determinations of individuals collected by using electrofishing techniques.

Organic particles were abundant in streamwater samples with turbidity readings up to about 60 NTU (nephelometric turbidity units), typically occurring during times of rising and falling streamflows. At higher turbidities and peak flows, the streamwater samples had a higher pro-

portion of inorganic materials. Organic materials were generally more abundant in samples collected during early-season storms. In previous studies of suspended sediment filtered out of streamwater samples, researchers commonly assumed that the material captured by the filter is all inorganic. Our results show that in four streams, the organic fraction of the sediment load is high (up to 80 percent) at low to moderate turbidity (5-30 NTU) and should be included in analyses of suspended-sediment concentrations.

Preliminary results show that the biomass of invertebrate prey sampled from the foreguts of juvenile coho salmon and steelhead trout declined with increasing turbidity. Our field observations also revealed a decline in the rate of prey capture by juvenile salmonids with increasing turbidity. These data are unique in that other studies of salmon feeding efficiency in response to turbidity or suspended-sediment concentrations have all been flume rather than field based. Although the efficiency of prey capture decreased at higher turbidities, limited fish feeding activity was still observed at the highest turbidity (45 NTU) in which underwater observations were made. These observations are important because many previous studies have as-

sumed that 30 NTU is a turbidity threshold above which fish cannot feed.

So far, we have found that the contribution of organic particles to the suspended-sediment load differs among streams and differs within streams on a seasonal and within-storm basis. Organic particles are major components of the suspended-sediment load at low and moderate turbidities, which typically occur as (1) streamflow begins to increase in response to a storm, (2) the stream returns to low flow, and (3) in winter, between storms. (In dry California summers, even the organic particles settle out of the water, leaving it quite clear.) These periods of low and moderate turbidity are likely the most relevant for determining the biologic health of a stream, even though they may not be the most relevant for estimating sediment yields from a basin.

Our field studies show that the efficiency of fish feeding is affected by turbidity but that limited feeding goes on even at moderate turbidities. How suspended-sediment composition is linked with the invertebrate-prey base and how the dynamics of suspended organic sediment change in estuarine environments have yet to be determined. ❁

USGS Monterey Bay Science: A Knowledge Bank Prototype

By Rex Sanders

The Knowledge Management project of the U.S. Geological Survey (USGS) Coastal and Marine Geology Program has just completed the first prototype of a Coastal and Marine Knowledge Bank, called MontereyBay.usgs.gov after its World Wide Web address, which is <http://MontereyBay.usgs.gov>. This geographically based prototype highlights the wealth of USGS data, information, and knowledge about the Monterey Bay National Marine Sanctuary and its associated coastal watersheds.

MontereyBay.usgs.gov is based on several components, or tools:

- News—stories relevant to Monterey Bay in the monthly internal USGS newsletter *Sound Waves*

- Digital Library—online scientific information from the USGS and other sources
- Field Data Catalog—information about USGS field activities and data, including bathymetry, gravity, magnetism, navigation, samples, and seismic data
- Map Server—an interactive map tool with base maps, sidescan-sonar imagery, bathymetry, topography, coastal data, geology, navigation data, sediment samples, and shaded relief
- Bibliography—selected publications by USGS authors and collaborators, 1970-2004. Many citations include links to the USGS Publications Warehouse at URL <http://infotrek.er.usgs.gov/pubs/>



MontereyBay.usgs.gov development began in June 2003 as part of the CMG Knowledge Management project, which is described at URL http://woodshole.er.usgs.gov/projects/project_get.php?id=knowledge&style=html. The nationwide team developing MontereyBay.usgs.gov includes

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Alan Allwardt (Santa Cruz, CA), **Theresa Burress** (St. Petersburg, FL), **Carolyn Degnan** (Menlo Park, CA), **Trent Faust** (St. Petersburg, FL), **Gerry Hatcher** (Santa Cruz, CA), **Heather Henkel** (St. Petersburg, FL), **Dennis Krohn** (St. Petersburg, FL), **Fran Lightsom** (Woods Hole, MA), **Guthrie Linck** (Woods Hole, MA), **Valerie Paskevich** (Woods Hole, MA), **Rex Sanders** (Santa Cruz, CA), **Jolene Shirley** (St. Petersburg, FL), and **Clint Steele** (Menlo Park, CA). The team coordinated its efforts with other USGS national knowledge-management efforts, including the National Map (URL <http://nationalmap.usgs.gov/>), the Enterprise Web Thesaurus (URL http://www.usgs.gov/library/eweb_thes.html), and the Publications Warehouse (URL <http://infotrek.er.usgs.gov/pubs/>).

Over the next year, **Rex Sanders** will work with partners in the Monterey Bay Crescent Ocean Research Consortium (MBCORC; URL <http://www.mbcorc.org>) to evaluate the usefulness of this prototype for a wide range of uses and to explore opportunities for collaboration on knowledge management.

The CMG Knowledge Management project just started work on a second prototype that will focus on the national topic of coastal-change hazards, to be described in a future issue of *Sound Waves*. ❁



Home page of <http://MontereyBay.usgs.gov>.

Outreach

Woods Hole Science Center Participates in an Open House at USGS Headquarters

By Chris Polloni

The U.S. Geological Survey (USGS) Woods Hole Science Center (WHSC) took part in an open house held at USGS headquarters in Reston, VA, to kick off Earth Science Week (October 10-16; see URL <http://www.earthsciweek.org/>). **Dave Nichols** and **Chris Polloni** drove to the National Center to showcase a three-dimensional display consisting of:

- three-dimensional project posters, viewable with ChromaDepth glasses (information available at URL <http://www.chromatek.com>), and
- the Geowall visualization system (information available at URL <http://www.geowall.org>), featuring linearly polarized (LP) and circularly polarized (CP) imagery viewed with the IVS Fledermaus software and “bat” (hand-held device for navigating through the imagery; information available at URL <http://www.ivs.unb.ca/>).

Preliminary viewings were provided on Friday, October 8, and the main event was held on Saturday, October 9, from 9 a.m. to 5 p.m. Thousands of visitors attended the open house, and the WHSC team were kept extremely busy providing assistance



The USGS Woods Hole Science Center's three-dimensional display draws a crowd at the USGS Reston Open House 2004.

with the Fledermaus bat to youngsters attempting to “fly” around the Puerto Rico Trench or over the South Carolina inner shelf. Each participant was given a Certificate of Achievement after demonstrating proficiency in handling the bat. Proud parents accepted the certificates, while the youngsters tried to sneak back for extra turns. The WHSC team were energized by the interest in virtual overflights of the study areas. The team will be adding more project data to the Geowall visualization

system, which will be used as a portable display for workshops and conference activities. A nonteam data set that drew interest was a virtual three-dimensional model of main-shock and aftershock hypocenters (points in the Earth where a fault begins to rupture) for the magnitude 6.0 Parkfield, CA, earthquake of September 28, 2004. The model was downloaded from the Broadband Seismic Data Collection Center's Web site at URL <http://>

(Open House continued on page 10)

(Open House continued from page 9)

eqinfo.ucsd.edu/special_events/2004/272/a/index.shtml and viewed on the Geowall system with a free viewer called iView3d (see URL <http://www.ivs.unb.ca/products/iview3d/>).

The preparation for this activity was supported by many team members, including **Ellen Mecray**, who handled logistics as the WHSC's outreach chair; **Nancy Soderberg**, Fact Sheets and DVDs; and **Glynn Williams**, signage. Posters for the visual displays were provided by **Larry Poppe**, **Jane Denny**, **Bill Schwab**, **Bill Danforth**, **Brad Butman**, **Tammy Middleton**, **Michael Bothner**, **Wylie Poag**, and **Uri ten Brink**. Video and graphics material were provided by **Dann Blackwood** (sea-floor video), **Page Valentine** (maps), and **Jeff Williams** (DVD). **Emile Bergeron** helped construct the filter holders for the Geowall system. **Peter Swarzenski** arranged to have a ground-water Open-File Report



*Certificates of Achievement generated by **Eric Morrissey** of the USGS Energy Team were distributed to proud parents.*

(“Submarine Ground-Water Discharge and Its Role in Coastal Processes and Ecosystems,” USGS OFR 2004-1226) sent directly to Reston. The Reston open-house team working onsite responded to all of our needs. We especially thank the folks

at the Geowall Consortium who helped us with advice on getting started: **Rob Newman** (Scripps Institution of Oceanography, University of California, San Diego), **Brian Davis** (USGS, Sioux Falls, SD) and **Geoffrey Phelps** (USGS, Menlo Park, CA). ☼

Ten Years of Ask-A-Geologist

By Rex Sanders

The Ask-A-Geologist project has answered more than 32,000 questions by e-mail since October 4, 1994. We encourage questions from students, teachers, and the general public, who enjoy getting answers from U.S. Geological Survey (USGS) scientists. People with questions can visit our Web site at URL <http://walrus.wr.usgs.gov/ask-a-geologist/> or e-mail questions directly to ask-a-geologist@usgs.gov.

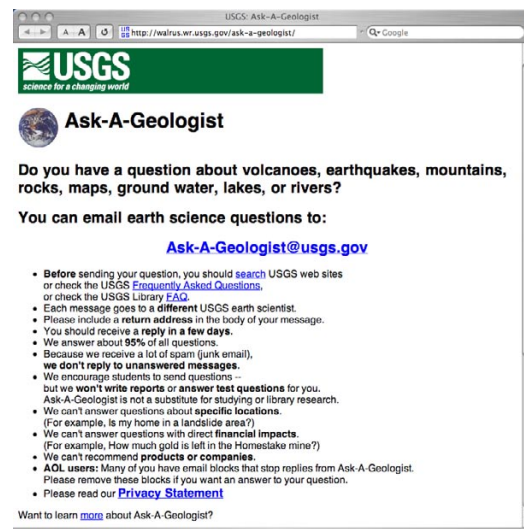
We began in the Branch of Pacific Marine Geology (now the Western Coastal and Marine Geology Team), using 35 scientists who volunteered to answer questions. For the first year, each scientist answered all the questions for a day. The service was so popular that some days they answered (or tried to answer) 50 questions!

In 1995, we recruited several hundred scientists from across the USGS who each answered a few questions. Today, 91 scientists answer questions, most answering about six questions apiece on one day each month.

Ask-A-Geologist, the Internet, and the USGS have been through many changes

since 1994, but a few things have remained constant:

- Anyone can e-mail a question to Ask-A-Geologist. We get questions from all over the United States, and a few from around the world. We get questions from grade-school students, teachers, college students, professionals, and the curious public.
- We try to answer all of the questions. Very few “ask a scientist” services try to answer all incoming questions. On average, we answer about 90 percent of all questions.
- The public likes to get replies from working scientists. We’ve received hundreds of thank-you e-mails from grateful correspondents. Many correspondents express appreciation for a personalized reply from a working scientist.
- USGS employees, contractors, emeriti, and volunteers answer all types of Earth-science questions, not just those on topics in their speciality. These



scientists get to use all of their Earth-science knowledge and often learn new things outside their specialty that enable better-integrated science.

- Ask-A-Geologist scientists enjoy answering the questions. No one is required to answer the questions, and so for all of them, this is a labor of love. Many enjoy working with the public in a way that minimizes the impact on their regular work.

(Ask-A-Geologist continued on page 11)

Outreach, continued

(Ask-A-Geologist continued from page 10)

- Nobody has been paid explicitly to work on Ask-A-Geologist, and no funds have been budgeted to run Ask-A-Geologist. The project is run by **Rex Sanders** (Santa Cruz, CA), with the assistance of **Carol Madison** (Menlo Park, CA). On average, **Rex** and **Carol** spend only a few hours per month working on Ask-A-Geologist, with custom software handling all the routine chores efficiently. The scientists who answer the questions often do so during lunch breaks, after hours, or from home.
- Six USGS scientists have answered Ask-A-Geologist questions since the beginning: **Peter Barnes, Ken Bird, Gretchen Luepke, Mike Marlow, Dave Scholl, and Andy Stevenson** (all in Menlo Park, CA). **Peter, Gretchen, Mike, and Dave** continue to answer questions after retiring from the USGS! Over the 10-year life of Ask-A-Geologist:
 - We received more than 94,000 e-mails (many were spam and were not answered).
 - We've answered more than 32,000 questions.
 - 425 USGS scientists participated in Ask-A-Geologist at least once.
 - Several other Earth-science research organizations have set up similar services and asked our project for advice, including the British Geological Survey and the Geological Survey of Canada.

What will the next 10 years be like for Ask-A-Geologist? See our next *Sound Waves* article in 2014! ❁

Awards

Scientists Save a Life, Win DOI's Exemplary Act Award

Last spring, a boy swept offshore in a rip current was rescued by biologists at the U.S. Geological Survey (USGS) Western Fisheries Research Center's Marrowstone Marine Field Station on Marrowstone Island (WA) at the northern entrance to Puget Sound. The employees who saved the boy—**Nancy Elder, Jacob Gregg, and Paul Hershberger**—were honored on October 13 at the Western Region Awards Ceremony, held in Menlo Park, CA, where they received the U.S. Department of the Interior's Exemplary Act Award. **Nancy, Jake, and Paul** were among several USGS Western Region employees who received Exemplary Act Awards, which recognize individuals for their prompt action in attempting to save the life of another without involving personal risk to the nominee. Here is their story, in an excerpt from the citation read by Western Regional Director **Doug Buffington** at the awards ceremony:

"On April 30, 2004, **Nancy Elder** mentioned to station chief **Paul Hershberger** that she had spotted children playing in



(Left to right) **Jake Gregg, Nancy Elder, and Paul Hershberger** at the USGS Marrowstone Marine Field Station, overlooking the area where they rescued a boy who had been swept offshore by a rip current.

the water in front of their laboratory. Soon after spotting the children, the staff heard screaming in the parking lot and immediately suspected that something was wrong. **Paul** ran out of his office and grabbed several life vests and float coats. At the northern point of the island, he saw a boy's head bobbing in the riptide, approximately 200 yards offshore, but realized that this was too far to throw a flotation device. **Nancy** immediately went to the wet lab to alert co-worker **Jake Gregg** that they had an emergency. While **Nancy** called the 911 opera-

tor, who transferred her to the U.S. Coast Guard, **Paul** and **Jake** decided to perform a difficult launch of their boat from the beach next to the lab. This quick thinking resulted in the successful rescue of the boy, who, at the time he was pulled onboard, was being swept offshore well into the shipping lanes. The boy was slowly warmed with blankets to bring up his body temperature. Were it not for the quick thinking and decision making of the USGS laboratory staff, the ending of this near-tragic event would have been much different." ❁

USGS Biologists Working in Coastal Areas Receive DOI Honor Awards at Western Region Awards Ceremony

Numerous U.S. Geological Survey (USGS) biologists conducting research in coastal areas received U.S. Department of the Interior (DOI) Honor Awards at the Western Region Awards Ceremony, held October 13, 2004, in Menlo Park, CA.

Research biologist **Gary M. Fellers** received a Meritorious Service Award, the second highest departmental honor award that can be granted to a career employee. **Gary** is stationed at the USGS Western Ecological Research Center (WERC)'s

Point Reyes Field Station (see URL <http://www.werc.usgs.gov/pt-reyes/>), where he leads research on the ecology and population status of amphibians, reptiles, small mammals, and carnivores. His current re-

(Biologists continued on page 12)

(Biologists continued from page 11)

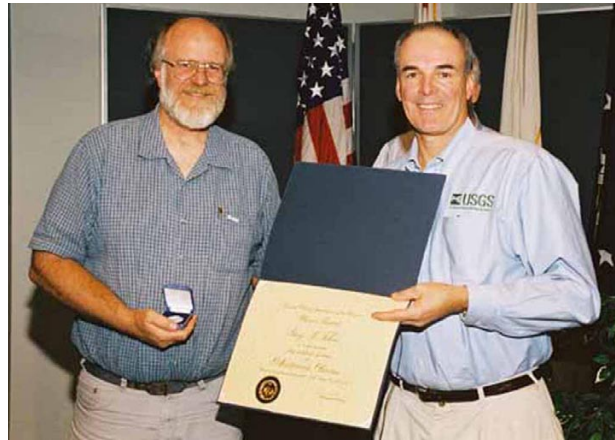
search focuses primarily on declining amphibians in nondesert parts of California, with most of the fieldwork taking place in the Sierra Nevada and the California Coast Ranges. Here is an excerpt from the citation read by Western Regional Director **Doug Buffington** at the awards ceremony:

Gary Fellers...“amassed one of the most significant data sets in the world to show without doubt that large-scale amphibian declines were occurring in several national parks....The successful USGS program known as the Amphibian Research and Monitoring Initiative [see URL <http://armi.usgs.gov/>] has been largely modeled after his California research program. In recognition of his outstanding contributions to the USGS through his dedication to the study of declining amphibians, and his international reputation for expertise in the field of declining amphibians, **Gary M. Fellers** is granted the Meritorious Service Award of the Department of the Interior.”

Several Superior Service Awards—granted for significant acts, services, or achievements that materially aid the successful accomplishment of the DOI and the USGS missions—went to researchers at WERC’s San Diego Field Station (see URL <http://www.werc.usgs.gov/sandiego/>). Research ecologist **Barbara Kus** studies birds inhabiting coastal drainages of southern California. During the awards ceremony, **Doug Buffington** noted that “**Barbara Kus** has played an important role in addressing the recovery of two riparian-dependent endangered species, the least Bell’s vireo and the southwestern



*Recipient of Superior Service Award for avian ecology studies, **Barbara Kus**. Photograph by **Mike Diggles**, USGS.*



***Gary Fellers** (left) receives a Meritorious Service Award from USGS Deputy Director **Bob Doyle**. Photograph by **Mike Diggles**, USGS.*

willow flycatcher....She is sought after by Federal, State, and local agencies to participate in the development of sound management plans for these species and to serve on recovery teams, working groups, and technical advisory committees. Her dedication to communicating research results to her clients, scientific colleagues, and the public is evidenced by her hosting and organizing conferences and symposia on the ecology and conservation of riparian birds. Her enthusiasm in pursuing, producing, and conveying science of relevance to our Department of Interior clients is commendable and a credit to our agency.”

Christopher W. Brown and **Carlton Rochester**, two more Superior Service awardees stationed in San Diego, are biologists working with research zoologist **Robert Fisher** on ecological-monitoring efforts in habitats that include coastal southern California. Here are excerpts from **Chris Brown**’s citation, read by **Doug Buffington** at the recent awards ceremony:

“**Christopher Brown** has led the USGS in the challenging task of database development for the Amphibian Research and Monitoring Initiative. He has taken his work on this program and extended it to the design of a multitaxa database, with direct entry of data from personal digital assistants [PDAs] from multiple sites—an incredibly important service to both research scientists and land managers throughout the United States. The database

structure that he was so skilled in developing is in high demand by USGS scientists and our Federal and State partners....He has made an enormous contribution to the research and monitoring of biological resources throughout the Nation.”

And an excerpt from **Carlton Rochester**’s citation:

“**Carlton Rochester** has become a valuable asset in revolutionary work with personal-digital-assistant [PDA] use and training that has moved USGS scientists from paper to digital data collection. Owing to his vision and determination, a data-collection system using PDAs has been developed that has eliminated transcription time and significantly reduced data error. Through his...tireless development and improvement of data-collection forms, he has expanded this functionality to include multiple taxa and increased the efficiency and productivity of data collection....He

(Biologists continued on page 13)



***Chris Brown** (left) receives a Superior Service Award from USGS Deputy Director **Bob Doyle** (right), while Western Regional Director **Doug Buffington** (center) looks on. Photograph by **Mike Diggles**, USGS.*

Awards, continued

(Biologists continued from page 12)

has shared his knowledge by supporting other scientists throughout the United States, and his expertise continues to be in demand by an ever-increasing client base.”

Kevin D. Lafferty, a marine ecologist at WERC’s Channel Islands Field Station (see URL <http://www.werc.usgs.gov/chis/>), won a Superior Service Award for his research on the threatened western snowy plover. Here is an excerpt from the citation read by **Doug Buffington** at the awards ceremony: “**Kevin Lafferty** has played an important role in addressing recovery of the western snowy plover, a threatened species that nests on the coast of California. Together with collaborators and a host of volunteers, [he helped protect a stretch of sand] at Coal Oil Point Reserve near Santa Barbara, resulting in [a steady increase in] the numbers of nesting plovers [and] providing the first evidence that a reduction in human disturbance can lead to recovery of a formerly abandoned breeding site. His efforts have received both local and national recognition, and his approach

has attracted the attention of Federal, State, and local land managers facing similar plover-human conflicts on west-coast beaches.” [See related articles in *Sound Waves*, February 2002, December 2003/January 2004, and February 2004.]

John Y. Takekawa, a research wildlife biologist stationed at WERC’s San Francisco Bay Estuary Field Station (see URL <http://www.werc.usgs.gov/sfbe/>), won a Superior Service Award for his work supporting tidal-wetlands restoration in San Francisco Bay. As noted at the recent awards ceremony, “**John Takekawa** has worked tirelessly to support a critical research need of the U.S. Fish and Wildlife Service, following their recent purchase of over 16,000 acres of salt ponds in San Francisco Bay, and is pursuing the largest tidal-restoration effort in the history of the bay. **John** and his co-investigators have been gathering critical baseline information on wildlife and fisheries habitat use, water quality, sediment chemistry and contaminants, and sediment dynamics. **John** took



Carlton Rochester, recipient of Superior Service Award for innovations in field-data collection. Photograph by **Mike Diggles**, USGS.

the initiative to assemble an interdisciplinary USGS team while also pursuing sources of funding for the research. His efforts have brought in over a million dollars of reimbursable funding to the USGS to support and expand this integrated research project.”

Photographs of the USGS 2004 Western Region Awards Ceremony can be viewed online at URL <http://www.diggles.com/awards2004/>. ❀

Staff and Center News

Oceanographer Joins the Western Coastal and Marine Geology Team

By Guy Gelfenbaum

Doug George has recently joined the U.S. Geological Survey (USGS) Western Coastal and Marine Geology Team as an oceanographer who will be working with **Guy Gelfenbaum**.

Doug received a B.S. in oceanography from Humboldt State University, an M.S. in journalism from Columbia University, and an M.Sc. in oceanography from Dalhousie University. His journalism thesis explored the effects of constructed wetlands on resident wildlife, and his graduate oceanography research focused on the midshelf sand-mud transition, metals transport, and wave-energy regimes. His thesis was part of the EuroSTRATAFORM project conducted in the Adriatic Sea (see related articles in *Sound Waves*, April 2003 and December 2002/January 2003). **Doug** also worked on the restoration of the Mississippi River delta at the Ocean Studies Board of the National Academy of Science.

At the USGS, **Doug** will be conducting numerical-modeling studies with **Guy, Peter Ruggiero**, and **Giles Lesser**. He will be using Delft3D software to model hydrodynamics and sediment transport in order to examine how restoring Capitol Lake (Washington) to an estuary may affect the environs of southern Puget Sound. **Doug** will also be involved in modeling efforts associated with the Elwha Dam removal and the Columbia River estuary, and will help with data collection in the field and presentation of the results of the studies.

Doug is stationed in Menlo Park, CA, in room 1209, Building 1 (phone: 650-329-5376). Please come by and welcome him to the USGS! ❀

***Doug George** processes a sea-floor-sediment sample on the deck of the Italian motor vessel Ermione in the Adriatic Sea.*



Students from the Netherlands Assist USGS Staff in Florida

By **Bram Dittrich** and **Twan Brinkhof**

Two interns from the Netherlands helped U.S. Geological Survey (USGS) scientists conduct fieldwork in Florida in September. **Bram Dittrich** and **Twan Brinkhof**, seniors majoring in land and water management at the Larenstein University of Professional Education in Velp, the Netherlands, are serving internships with the U.S. Geological Survey (USGS) and the National Park Service (NPS) as USGS Volunteers for Science and NPS International Volunteers-in-Parks. During their three-month internship, they are working primarily in Everglades National Park on the USGS Dynamics of Land-Margin Ecosystems Project, with USGS scientists **Gordon Anderson** and **Tom Smith**.

From September 21 to 23, the students had an opportunity to assist the USGS Florida Integrated Science Center (FISC) staff at Altamonte Springs, FL, with field monitoring after Hurricanes Charley and Frances. On the first day, the students helped monitor ground-water-well potential. **Bram** assisted **Mike Beckwith** in Orange County, and **Twan** helped **Aram Nazarian** in the area to the south, near Lake Okeechobee. Data from wells in these areas are published twice a year.

The next two days, both students performed canal-discharge measurements

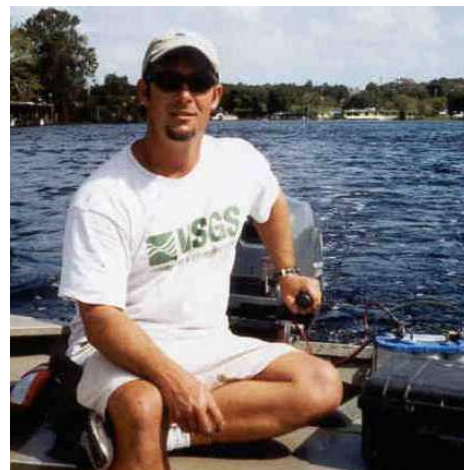


*Dutch students **Bram Dittrich** (left) and **Twan Brinkhof** in the Big Cypress National Preserve, adjacent to Everglades National Park, FL.*

with an acoustic Doppler current profiler, an instrument that uses sound waves and the Doppler effect to measure water velocity at numerous points above the bottom.

Bram worked with **Sonny Anderson** measuring discharges at the St. John's River. **Twan** measured canal discharges with **Scott Greenwood** at Taylor Creek and canal L-63S, in the area north of Lake Okeechobee. While driving across central Florida, they saw the devastation caused by Hurricanes Charley and Frances. Water heights were extremely high at Taylor Creek. Shortly after measurements were taken, Hurricane Jeanne ravaged the area.

Also involved with the students' visit were **Molly Wood**, **Ed Simonds**, and **Dave Brown**, all from Altamonte Springs. ❁



***Sonny Anderson** on the St. John's River.*



***Mike Beckwith** holds a weighted tape measure called a Nubian tape. The weight is lowered to the water's surface, and the tape is read against a fixed point on the bridge or culvert. The weight keeps the tape taut.*



Water level at Taylor Creek reached nearly record heights.

USGS Represented in Local Parade in Woods Hole, MA

By Chris Polloni and Sandy Baldwin

Woods Hole, MA, is known for its many local festivals and town activities. Johnny Rotten Day is a day of remembrance for Woods Hole postmaster **John Klink**. Though **John** affected a gruff, uncaring attitude, his façade was transparent, and his love of the town was returned by all who knew him. Begun in 1995 when **John** retired, the festival is a gathering of locals playing Celtic music and bag pipes, sharing good food, and enjoying good company. The Brian Boru Pipe Band, from Falmouth, is a frequent contributor to the

Johnny Rotten Day festivities, playing arrangements of Irish pipe music in his honor. **Sandy Baldwin**, from the USGS Woods Hole Science Center, is a new member of the band; she plays bass and tenor drums. ❁

***Sandy Baldwin**, who works at the USGS Woods Hole Science Center, playing the drum in the Johnny Rotten Day parade in Woods Hole, MA.*



Publications

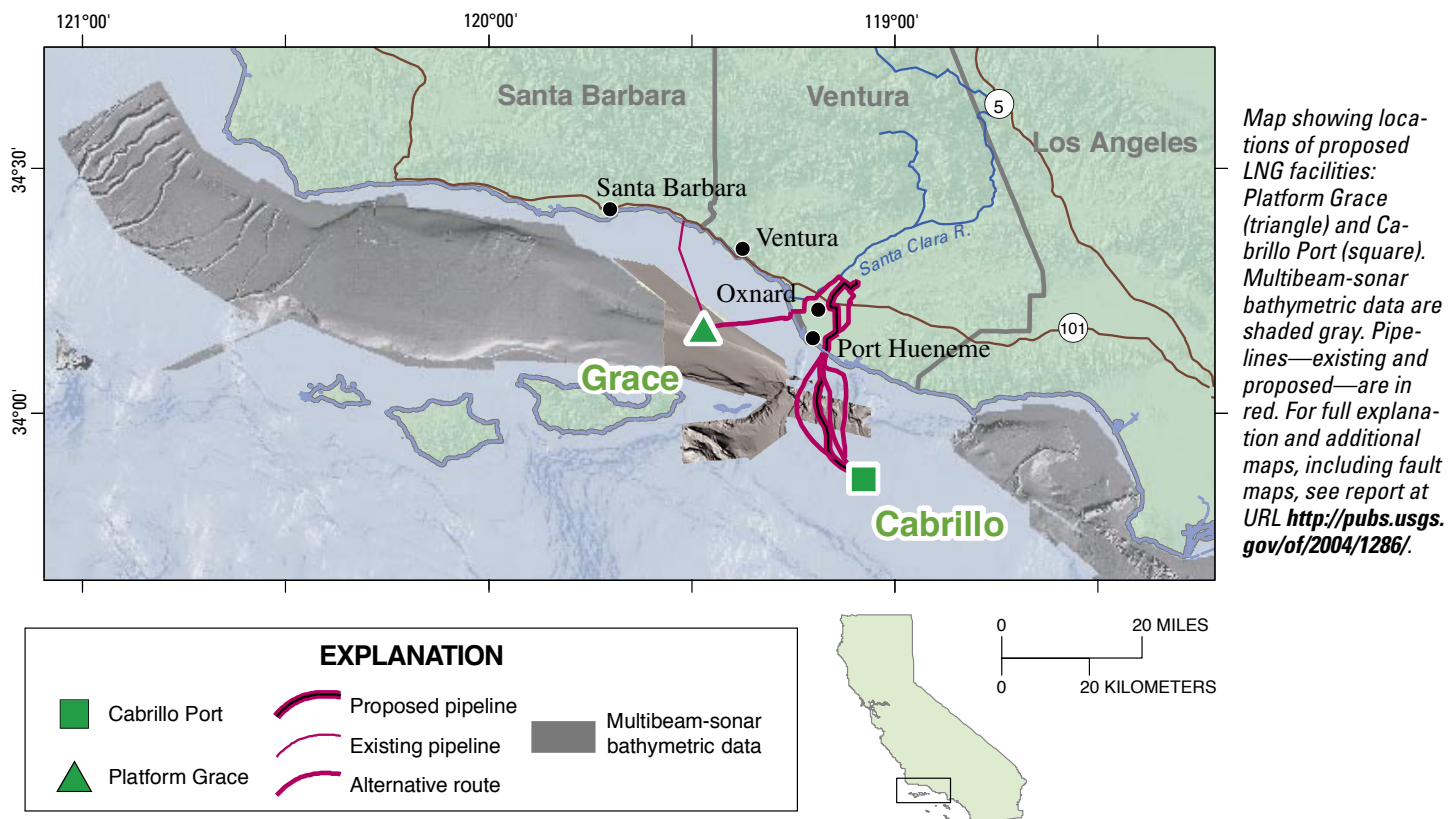
Report on Hazards Offshore California's Ventura County Coast Compiled in Response to Congressional Request

By Helen Gibbons

U.S. Geological Survey (USGS) scientists recently released "Comments on Potential Geologic and Seismic Hazards Affecting Coastal Ventura County, Califor-

nia" (USGS Open-File Report 2004-1286, URL <http://pubs.usgs.gov/of/2004/1286/>) in response to a request from Congresswoman **Lois Capps** (Santa Barbara, CA),

who sent a letter to the USGS in June requesting advice on geologic hazards that should be considered in the review of two
(Ventura County Coast continued on page 16)



Publications, continued

(Ventura County Coast continued from page 15)

proposed liquefied-natural-gas (LNG) facilities offshore Ventura County, CA. A team of USGS scientists from Menlo Park, CA, Pasadena, CA, and Golden, CO, assembled the Open-File Report, which was published and sent to **Congresswoman Capps** in August. Based on previously compiled, publicly available and existing data on seismic activity in the area, the report shows a potential for major earthquakes that could damage the LNG facilities. The report's authors identify additional investigations that could be performed to produce more detailed recommendations.

Congresswoman Capps' request was prompted by proposals from two companies, BHP Billiton and Crystal Energy, to site LNG terminals off Ventura County's

coastline. Both facilities would convert the liquid back into a gas and then ship it to an onshore Southern California Gas Co. facility through a system of pipes on the sea bottom. BHP Billiton wishes to build a permanently moored deep-water LNG regasification facility, called Cabrillo Port. The floating terminal would be located 14 mi off the county's south coast, anchored to ocean-floor pipelines. Crystal Energy seeks to use Platform Grace, an offshore oil platform 12 mi off Oxnard, as a docking site for ships importing LNG. (See *Sound Waves* article about mapping benthic habitat in the area that includes Platform Grace, this issue.)

On the basis of the USGS report, **Congresswoman Capps** is asking the Federal

Energy Regulatory Commission, the U.S. Coast Guard, the Department of Energy, and the Department of Transportation to investigate possible seismic activity in the Santa Barbara Channel region before deciding whether to endorse construction of the LNG import facilities. More information about this issue is available on **Congresswoman Capps'** Web site at URL <http://www.house.gov/capps/>.

The USGS Open-File Report, by **Stephanie L. Ross, David M. Boore, Michael A. Fisher, Arthur D. Frankel, Eric L. Geist, Kenneth W. Hudnut, Robert E. Kayen, Homa J. Lee, William R. Normark, and Florence L. Wong**, can be downloaded from URL <http://pubs.usgs.gov/of/2004/1286/>. ❁

USGS Scientists Contribute Chapters to New Book About Point Loma in San Diego, CA

By Gloria Maender

The Cabrillo National Monument Foundation unveiled a new book on Point Loma's natural resources, *Understanding the Life of Point Loma*, with a book sign-



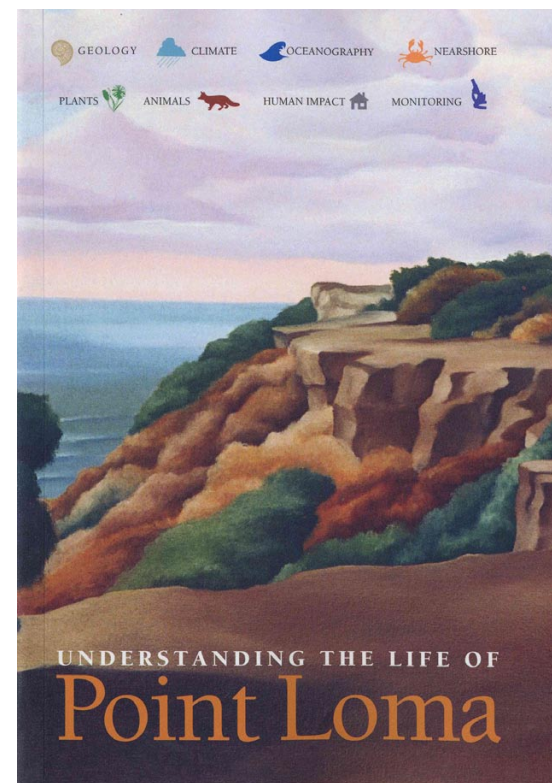
California kingsnake photographed by **Christopher W. Brown, USGS**. This is one of 16 photographs by **Brown** illustrating **Robert Fisher's** chapter on the diversity of animal life in the book *Understanding the Life of Point Loma*. (Additional information about the California kingsnake is available at URL <http://www.werc.usgs.gov/fieldguide/lage.htm>.)

ing on September 19 at the James Edgar and Jean Jessop Hervey Point Loma Library in San Diego. Two U.S. Geological Survey (USGS) scientists from the Western Ecological Research Center, **Kathryn McEachern** and **Robert N. Fisher**, are chapter authors, and **Fisher** was on hand at the book signing.

Cabrillo National Monument Superintendent **Terry M. DiMattio** described the book as the first to be "written specifically about the natural resources of Point Loma, both those found on the peninsula and those from the kelp forest offshore to the tidepools, where the ocean meets the land."

The seven-chapter book provides a grounding in Point Loma's geologic history, climate and oceanography, nearshore environment, plant communities, animals, and history of human impacts, as well as a description of ongoing efforts to preserve Point Loma's natural resources and educate people about its unique natural systems.

"The chapters written by the USGS scientists **Kathryn McEachern** and **Robert Fisher** are captivating," said **DiMattio**. "They provide the reader with insight into



Cover of the new book.

the workings of the plant and animal communities on this interesting, islandlike peninsula within the city limits of San Diego."

In chapter 4, "A Mediterranean Place: Plant Communities," plant ecologist **Kathryn McEachern** discusses the fasci-

(Book continued on page 17)

(Book continued from page 16)

nating and different ways in which plants have adapted to take advantage of the Mediterranean climate's winter rain, yet survive its summer drought. Additionally, the plants have evolved with fire and have developed strategies of renewal, some resprouting from fire-resistant stems or roots after fire ("sprouters"), and others ("seeders") establishing seed crops that sprout new plants after fire. **McEachern** describes the native plant communities and their distribution on Point Loma, the history of vegetation in the area, and conservation challenges.

In chapter 5, "Life on the 'Island': Animals," research zoologist **Robert N.**

Fisher describes how Point Loma was and is like an island to many animals. Historically, it was isolated from the mainland by water and, likely, marshland; today it is isolated by development. Point Loma has "20 species of mammals, 12 species of reptiles, 1 amphibian, and more than 250 species of birds." **Fisher** discusses "island" animals, from invertebrates to carnivores and raptors, and discusses such threats as invasive Argentine ants, feral cats, and poaching of reptiles and amphibians.

The 184-page paperback is available at the Cabrillo National Monument bookstore and retails for \$16.95.✻



Buckthorn, a "seeder" plant. In Mediterranean ecosystems, seeders are plants that respond to recurring fires by sprouting new plants from seeds laid down in the soil during intervals between fires. This photograph by Kathryn McEachern is among the images illustrating her chapter on plant communities in the book Understanding the Life of Point Loma.

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